IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the Application of:	)
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ETORI et al	) Examiner: Cruz
	)
Serial No.: 09/740,809	) Art Unit: 2851
	)
Filed: December 21, 2000	)
	)
For: A SEE-THROUGH LIGHT TRANSMITTING TYPE SCREEN	)

DECLARATION OF HIDEKI ETORI UNDER 37 CFR 1.132

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

I, Hideki ETORI, hereby declare as follows:

1. I am a citizen of Japan residing at 6-252-6 A-104, Mihashi, Nishi-ku, Saitama-shi, Saitama-ken, Japan.

2. I am one of the coinventors of the invention described and claimed in the captioned application and I am familiar with the office actions issued in connection with that application, as well as the references cited by the examiner in those in office actions.

3. The claims pending in the captioned application define the screen of the invention as "see-through". As taught in the paragraph spanning pages 1 and 2 and in the first full paragraph at page 2 of applicants' specification, the object of the present invention is to provide a screen "that enables the viewer to see through it to its back side", e.g., to see goods displayed within a store from outside the store looking through the screen, and which forms clear images projected from a projector. Our use of the term "see-through" is consistent with use of this terminology in the relevant art. See, for example, column 19, lines 51-64 of U.S. 6,481,851, attached hereto.

It can be appreciated that the "see-through" property requires some degree of transparency but that an increase in transparency is detrimental to the clarity of an image projected onto the screen. Prior to our invention, it was generally supposed that good "see-through" would require a reduction in light scattering to the point where the transmitted light would dazzle an observer. Our invention is believed to be the first truly "see-through" projection screen which also provides for clarity of an image projected thereon.

4. The "see-through property" can be empirically defined as "distinctness of image" in accordance with JIS-K7105 as taught at page 3, line 17 to page 4, line 6 of our original specification. See pending claim 6.

5. In my opinion, Watanabe et al - U.S. 6,262,840 do not disclose a "see-through" screen and I believe that from a reading of the teachings of Watanabe et al others skilled in the art would reach the same conclusion. I base my conclusion on a number of features of their screen described

by Watanabe et al.

Firstly, Watanabe et al describe their invention as "a rear-projection type video display apparatus." See, for example, column 1, lines 8-19 of Watanabe et al.

Secondly, Watanabe et al describe their screen as a "plano lens". See, for example, column 4, lines 24-26. It can be appreciated from the drawing figures that it would be difficult to see-through the screen of Watanabe et al used, for example, on a store window, to make out a display of goods within the store as described at pages 1 and 2 of our specification.

Thirdly, Watanabe et al teach (column 15, lines 58-60) that the screen gain (SG) at 30 degree from the front should be more than one third of the peak screen gain (SG of the front). In order to satisfy this condition, the light scattering property of the screen must be so high that the screen would have low transparency (low see-through property). In contradistinction, the screen according to the invention, which has a distinctness of image (clarity of transmitted image) of 58% (approximately the lower limit recited by claim 6), has the screen gain at 30 degrees of 0.5% of the peak screen gain. Even the screen having a distinctness of image of 10%, which is far below the range recited by claim 6, has a screen gain (30 degree) of only 5% of the peak gain. Thus, the screen of Watanabe et al is quite different from the screen of the invention.

Fourthly, the "balls" of Watanabe et al are not of a sufficiently small particle size to allow "see-through". Watanabe et al at column 11, lines 44-62 teach that the diameter of the "balls" is

equal to or smaller than 100 μm. Watanabe et al set forth no teaching which would lead to the particle diameter within the range recited by claim 5 or sufficiently small to give the "see-through" quality required by claim 1.

Fifthly, Watanabe et al do not disclose a suitable relationship between the refractive index of the ball and that of the surrounding binder. At column 15, lines 2-6 Watanabe et al teach only that the refractive index is changed from the center of the screen to the outermost periphery to make a light scattering in the center of the screen higher and to reduce the amount of light towards the front of the screen in the center, since the light scattering becomes higher with an increase in the refractive index of the balls.

Sixth, those skilled in the art would understand that the invention of Watanabe et al is based on geometrical optics from a reading of column 12, lines 9-21 where Watanabe et al teach: "a light converging effect is determined in response to a value of the refractive index of the surrounding portions on the light incidence end side of the minute transparent ball and a value of the refractive index of the minute transparent ball, and hence a diffusion angle on the light emission side of the minute transparent ball is determined".

It is well known in the art that light diffusion (scattering) by a spherical particle is determined by a size parameter (q), which is represented by $q = \pi D/\lambda$, wherein D is the diameter of the particle and λ is the wavelength of the light in the medium. Geometric optics, i.e., the ordinary laws of reflection-refraction (Snell law, etc.) can be applied to a system where the size parameter is

sufficiently large, that is, the diameter is sufficiently large relative to the wavelength of the light. However, if the size parameter (q) is too small, that is, if the diameter is too small, geometric optics cannot be applied. Especially, when the diameter (D) is very small ($q \ll 1$), Rayleigh scattering occurs and the incident light is scattered not only forward (direction of the incident light) but also backward in the same light amount. The ordinary refraction law (Snell law) does not apply in this situation.

There is a region between a system in which the ordinary refraction law applies and the Rayleigh scattering system. In this region, the size parameter is larger than that of the Rayleigh scattering system and smaller than that of geometric optics, typically more than 1 and less than 50. Scattering occurring in this region is called Mie scattering, where the forward scattering is greater than the backward scattering and scattering is influenced by the particle diameter and not explained by the ordinary laws of refraction. Only in a system satisfying the conditions for Mie scattering can a see-through property and forward scattering be obtained simultaneously.

As clearly taught at page 1, lines 13-15 of applicants' substitute specification, the screen of the invention provides Mie scattering and therefore can simultaneously provide a see-through property and forward scattering. Particularly, the diameter of particles and the relative refractive index of the particles as recited in claim 5 are important parameters for imparting these properties to the screen. On the other hand, as afore-mentioned, the screen of Watanabe et al is based on geometric optics, not Mie scattering, and, therefore, the teachings of Watanabe et al do not enable such a see-through property.

Seventh and finally, haze and distinctness of image have a trade-off relationship. Specifically, when haze is high, diffusion becomes high and distinctness of image through a screen is lowered. Distinctness of image also changes depending on distance of an object from the screen. Even if the screen has a high diffusion, distinctness of image of an object becomes high when it is brought into contact with the screen. That is, the object can be seen well. Images focused on a screen, similarly to the object in close contact with the screen, can be seen well even through a screen having a high diffusion. However, this cannot be applied to the background of the object. The background, which is spaced from the screen, becomes vague if the screen has high diffusion. Since the screen of Watanabe et al is designed to have a high diffusion, it should have a high haze value and any image of an object in the background, which is spaced from the screen, becomes vague while the projected image can be seen clearly. Particularly, because light through the screen of Watanabe et al is scattered according to geometric optics as mentioned above, alignment of a light beam through the screen will be disordered and thereby the background cannot be observed. Thus, the screen of Watanabe et al cannot have a see-through property.

6. The undersigned further declares that all statements made herein of my own knowledge and belief are believed true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Hideki Etori July/24/2003

Hideki Etori date